

10-4 Common Logs

$$\log_{10} x$$

log x

Base of 10

The common logs are used in:

- the richter scale
- pH levels
- decibels of sound

Solve

$$\log_{10} x = 1.65$$

$$10^{1.65} = x$$

$$\log y = 1.34$$

$$44.67 \approx x$$

$$\log z = 1.08$$

$$y = 21.88$$

$$\log 44.67$$

$$\log 12 = 1.08$$

Calculator

$$\log 45 \approx$$

$$\log 22 \approx$$

$$\log 12 \approx$$

Solving Exponential Equations

ex

$$3^x = 27$$

$$3^x = 3^3$$

$$x = 3$$

Solving Exponential Equations

ex

$$3^{2x} = 5$$

$$\begin{aligned} \log 3^{2x} &= \log 5 \\ 2x \log 3 &= \log 5 \\ \frac{2x \log 3}{2 \log 3} &= \frac{\log 5}{2 \log 3} \\ x &= \frac{\log 5}{(2 \log 3)} \\ x &\approx .7325 \end{aligned}$$

ex

$$2^x = 7$$

$$\begin{aligned} \log 2^x &= \log 7 \\ x \log 2 &= \log 7 \\ x &= \frac{\log 7}{\log 2} \\ x &\approx 2.8074 \end{aligned}$$

ex:

$$\frac{1}{2}^x \geq 6$$

$$\log \frac{1}{2}^x \geq \log 6$$

$$x \log \frac{1}{2} \geq \log 6$$

Test $\log \frac{1}{2}$, if \log flip symbol

$$\begin{aligned} x &\leq \frac{\log 6}{\log (\frac{1}{2})} \\ x &\leq -2.5850 \end{aligned}$$

ex:

$$42^{x-1} = 17^{3x-1}$$

$$\begin{aligned} (x-1) \log 42 &= (3x-1) \log 17 \\ x \log 42 - \log 42 &= 3x \log 17 - \log 17 \\ x \log 42 - 3x \log 17 &= \log 42 - \log 17 \\ x(\log 42 - 3 \log 17) &= \log 42 - \log 17 \\ x &= \frac{(\log 42) - \log 17}{(\log 42) - 3 \log 17} \\ &= -1.899 \end{aligned}$$

ex:

$$8^{2x-1} = 39^{x+1}$$

$$(2x-1) \log 8 = (x+1) \log 39$$

$$2x \log 8 - \log 8 = x \log 39 + \log 39$$

$$2x \log 8 - x \log 39 = \log 8 + \log 39$$

$$x(2 \log 8 - \log 39) = \log 8 + \log 39$$

$$\begin{aligned} x &= \frac{(\log 8) + \log 39}{(2 \log 8) - \log 39} \\ x &\approx 11.5945 \end{aligned}$$

$$2^{2x+3} = 3^{3x}$$

$$1.0890$$

ex

Evaluate

$$\log_2 9 = y \approx 3.1699$$

$$2^y = 9$$

$$y \log 2 = \log 9$$

$$y = \frac{\log 9}{\log 2}$$

Cannot do on calc because base of 2

Change of Base Formula

$$\log_a n = \frac{\log_b n}{\log_b a} \quad \begin{array}{l} n > 0 \\ a > 0 \end{array}$$

$$\log_2 9 = \frac{\log 9}{\log 2} \quad \begin{array}{l} b > 0 \\ b \neq 1 \end{array}$$

$$a \neq 1$$

ex

$$\log_4 7 = \frac{\log 7}{\log 4} \approx 1.4037$$

ex

$$\log_3 5 = \frac{\log 5}{\log 3} \approx 1.4650$$

Do:

$$1. \log_7 12 \approx 1.2776$$

$$2. \log_5 3 \approx .6826$$

$$3. 2^{3x} = 7 \quad x \approx -.9358$$

$$\begin{array}{l} p550 \\ 28-34 \\ \text{even} \end{array}$$

$$\log_5 \frac{10}{3}$$

$$\log_5 10 - \log_5 3$$

$$\log_5 5 + \log_5 2 - \log_5 3$$